

इंटरनेट

मानक

### Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

“जानने का अधिकार, जीने का अधिकार”

Mazdoor Kisan Shakti Sangathan

“The Right to Information, The Right to Live”

“पुराने को छोड़ नये के तरफ”

Jawaharlal Nehru

“Step Out From the Old to the New”

IS 10871 (1984): Code of safety for hydrazine and hydrazine hydrate [CHD 8: Occupational Safety, Health and Chemical Hazards]



“ज्ञान से एक नये भारत का निर्माण”

Satyanarayan Gangaram Pitroda

“Invent a New India Using Knowledge”



“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”

Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”



BLANK PAGE



**IS : 10871 - 1984**  
**(Reaffirmed 1995)**

*Indian Standard*

**CODE OF SAFETY FOR  
HYDRAZINE AND HYDRAZINE HYDRATE**

**( First Reprint OCTOBER 1998 )**

**UDC 614.878 : 547.234**

**© Copyright 1984**

**BUREAU OF INDIAN STANDARDS  
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG  
NEW DELHI 110002**

**Gr 5**

**August 1984**

**AMENDMENT NO. 1 FEBRUARY 2007  
TO  
IS 10871 : 1984 CODE OF SAFETY FOR HYDRAZINE  
AND HYDRAZINE HYDRATE**

*(Page 4, clause 3.2.2) — Substitute '2°C' for '1.4 to 2°C' and '-51°C' for '-51.7°C'.*

*(Page 4, clause 3.2.3) — Substitute '120.1°C' for '118-119°C'.*

*(Page 8, clause 4.1.1) — Substitute '0.01 ppm' for '0.1 ppm'.*

*(Page 8, clause 4.1.5) — Add the following new clause after 4.1.5:*

**'4.1.6 Hydrazine and hydrazine hydrates are confirmed animal carcinogen with unknown relevance to humans.'**

**(CHD 8)**

---

**Reprography Unit, BIS, New Delhi, India**

# Indian Standard

## CODE OF SAFETY FOR HYDRAZINE AND HYDRAZINE HYDRATE

### Chemical Hazards Sectional Committee, CDC 18

#### *Chairman*

**SHRI S. C. KALE**,

#### *Representing*

Directorate General, Factory Advice Services &  
Labour Institute (Ministry of Labour),  
Bombay

#### *Members*

<b>DR V. P. GUPTA</b> ( <i>Alternate to</i> <i>Shri S. C. Kale</i> )	
<b>SHRI K. D. AMBE</b>	National Organic Chemical Industries Ltd, Bombay
<b>SHRI M. C. PATWARDHAN</b> ( <i>Alternate</i> )	
<b>SHRI C. N. CHANDRASEKHAR</b>	Directorate General Ordnance Factories ( Ministry of Defence ), Calcutta
<b>SHRI CHARANJIT LAL</b>	Controller of Explosives, Nagpur
<b>SHRI B. R. DAVE</b> ( <i>Alternate</i> )	
<b>DR D. CHOUDHARI</b>	Indian Chemical Manufacturers' Association, Calcutta
<b>SHRI D. K. SIRKAR</b> ( <i>Alternate</i> )	
<b>SHRI A. M. DAND</b>	Indian Petrochemicals Corporation Ltd, Vadodra
<b>SHRI D. L. VYAS</b> ( <i>Alternate</i> )	
<b>DEPUTY DIRECTOR ( CHEM ),</b> RDSO, LUCKNOW	Railway Board ( Ministry of Railways )
<b>DR S. S. GOTHOSKAR</b>	Directorate General of Health Services, New Delhi
<b>SHRI R. BALASUBRAMANYAN</b> ( <i>Alternate</i> )	
<b>SHRI K. C. GUPTA</b>	National Safety Council, Bombay
<b>SHRI N. RAGHAVAN</b> ( <i>Alternate</i> )	
<b>SHRI C. HINGARH</b>	Century Rayon, Kalyan
<b>SHRI J. J. ADHIA</b> ( <i>Alternate</i> )	
<b>DR V. R. B. MATHUR</b>	Directorate General of Technical Development, New Delhi
<b>SHRI P. O. NANGIA</b>	Hindustan Organic Chemicals Ltd, Rasayani
<b>SHRI A. G. SHESH</b> ( <i>Alternate</i> )	
<b>DR K. NARAYANAN R</b>	Bhabha Atomic Research Centre, Bombay
<b>DR D. J. PARIKH</b>	National Institute of Occupational Health, Ahmadabad
<b>DR S. B. RAY</b>	Ministry of Defence ( DGI ), Pune
<b>SHRI T. N. REWAL</b>	Ministry of Defence ( DGI ), Kanpur
<b>SHRI P. DUTTA</b> ( <i>Alternate</i> )	
<b>SHRI N. K. SAMANTA</b>	Indian Explosives Ltd, Calcutta
<b>SHRI A. SINHA</b> ( <i>Alternate</i> )	

( Continued on page 2 )

© Copyright 1984

BUREAU OF INDIAN STANDARDS

This publication is protected under the *Indian Copyright Act* ( XIV of 1957 ) and reproduction in whole or in part by any means except with written permission of the publisher shall be deemed to be an infringement of copyright under the said Act.

( Continued from page 1 )

<i>Members</i>	<i>Representing</i>
DR P. N. VISWANATHAN	Industrial Toxicology Research Centre ( CSIR ), Lucknow
DR B. N. GUPTA ( <i>Alternate</i> )	
SHRI S. K. MATHUR, Director ( Chem )	Director General, ISI ( <i>Ex-officio Member</i> )
	<i>Secretary</i>
	SHRI K. K. TRIPATHI Senior Deputy Director ( Chem ), ISI

### Industrial Chemical Hazards Subcommittee, CDC 18 : 4

<i>Convener</i>	
SHRI S. C. KALE	Directorate General, Factory Advice Services Labour Institute ( Ministry of Labour ), Bombay

<i>Members</i>	
DR V. P. GUPTA ( <i>Alternate</i> to Shri S. C. Kale )	
SHRI G. R. BALASUBRAMANIAN	Bhabha Atomic Research Centre, Bombay
SHRI CHARANJIT LAL	Controller of Explosives, Nagpur
SHRI B. R. DAVE ( <i>Alternate</i> )	
DR S. R. CHAUDHURY	All India Institute of Hygiene & Public Health, Calcutta
DR D. CHOUDEURI	Union Carbide of India Ltd, Calcutta
DEPUTY DIRECTOR ( CHEM ), RDSO, LUCKNOW	Railway Board ( Ministry of Railways )
SHRI V. N. GODBOLE	Albright Morarji and Pandit Ltd, Ambernath
SHRI K. R. PRABHU ( <i>Alternate</i> )	
SHRI K. C. GUPTA	National Safety Council, Bombay
SHRI N. RAGHAVAN ( <i>Alternate</i> )	
SHRI P. V. KANGO	Indian Chemical Manufacturers' Association, Calcutta
DR R. V. SUBRAMANIAM ( <i>Alternate</i> )	
DR C. R. KRISHNAMURTI	Industrial Toxicology Research Centre ( CSIR ), Lucknow
DR P. N. VISWANATHAN ( <i>Alternate</i> )	
DR S. L. MERTA	Century Rayon, Kalyan
SHRI R. K. SHUKLA ( <i>Alternate</i> )	
DR O. P. MITTAL	Ciba-Giegy of India Ltd, Bombay
DR C. S. NAIR	The Fertilizer and Chemicals Travancore Ltd, Udyogmandal
DR D. J. PARIKH	National Institute of Occupational Health, Ahmadabad
SHRI J. D. PARIKH	The Atul Products Ltd, Atul
SHRI M. V. DESAI ( <i>Alternate</i> )	

( Continued on page 17 )

# *Indian Standard*

## CODE OF SAFETY FOR HYDRAZINE AND HYDRAZINE HYDRATE

### 0. FOREWORD

**0.1** This Indian Standard was adopted by the Indian Standards Institution on 30 April 1984, after the draft finalized by the Chemical Hazards Sectional Committee had been approved by the Chemical Division Council.

**0.2** Hydrazine is largely used in photography, metal processing and food processing industry. It is used for the preparation of anti-corrosives, textile agents, insecticides, pharmaceuticals, silvering of mirrors, etc. Being a rocket fuel, it finds application in space technology. Hydrazine hydrate is used as an intermediate in organic synthesis. It is widely used in photography, metal processing preservatives, preparation of anti-corrosives, textile agents, insecticides and pharmaceuticals.

**0.3** Hydrazine hydrate is a colourless fuming liquid and a reactive material with a variety of biological effects and considerable toxicity. It is corrosive and poisonous and requires the same precautions applicable for anhydrous hydrazine. Small amounts of vapour are irritating to the eyes, mucous membranes and skin. The liquid is caustic and can cause severe burns when splashed on the skin. Splashes in eye can result in permanent damage. Anhydrous hydrazine and hydrazine hydrate are highly flammable and react violently with many materials.

**0.4** In the preparation of this code, assistance has been derived from the following publications:

- a) PATTY (FRANK A). Industrial hygiene and toxicology. VII. 1962. Ed 2. Interscience Publishers, USA.
- b) SAX (N IRVING). Dangerous properties of industrial materials. 1979. Ed 5. Van Nostrand Reinhold Company, USA.
- c) National Fire Code. V13. 1976. National Fire Protection Association (NFPA), USA.
- d) Merck Index (an encyclopaedia of chemicals and drugs). 1968. Ed 8. Merck & Co. Inc, USA.



## 1. SCOPE

1.1 This standard covers the properties of hydrazine and hydrazine hydrate ( 100 percent ), nature of hazards associated with it, preventive measures for controlling the hazards and essential information on storage, handling, packing, labelling, employee education, personal protective equipment and first aid.

1.2 This code does not deal with specification for design of buildings, process equipments, storage vessels, etc.

## 2. TERMINOLOGY

2.1 For the purpose of this standard, the definitions given in IS : 4155-1966\* and IS : 4167-1966† shall apply.

## 3. GENERAL INFORMATION AND PROPERTIES

### 3.1 General Information

	<i>Hydrazine</i>	<i>Hydrazine Hydrate</i>
<i>Common name</i>	Hydrazine diamine	Hydrazine hydrate
<i>Chemical name</i>	Hydrazine	Hydrazine hydrate
<i>Empirical formula</i>	$\text{H}_2\text{NNH}_2$	$\text{H}_2\text{NNH}_2 \cdot \text{H}_2\text{O}$
<i>Molecular formula</i>	$\text{N}_2\text{H}_4$	$\text{N}_2\text{H}_6\text{O}$
<i>Molecular mass</i>	32.05	50.1

### 3.2 Physical Properties

<b>3.2.1</b> <i>Description, Colour, Odour and Physical State</i>	Colourless, oily liquid fuming in air with penetrating odour resembling that of ammonia	Fuming refractive liquid, faint characteristic odour
<b>3.2.2</b> <i>Melting Point/Freezing Point</i>	1.4 to 2°C	— 51.7°C
<b>3.2.3</b> <i>Boiling Point ( at Pressure )</i>	113.5°C ( 760 mm )	118-119°C ( 740 mm )
<b>3.2.4</b> <i>Specific Gravity ( 15°C )</i>	1.011	1.038
<b>3.2.5</b> <i>Refractive Index</i>	1.469 8	1.428

\*Glossary of terms relating to chemical and radiation hazards and hazardous chemicals.

†Glossary of terms relating to air pollution.

	<i>Hydrazine</i>	<i>Hydrazine Hydrate</i>
<b>3.2.6 Viscosity</b>	0.009 dynes/cm <sup>2</sup>	Not available
<b>3.2.7 Vapour Pressure</b>	14.4 mm of Hg at 25°C	,,
<b>3.2.8 Heat of Freezing</b>	3.025 kcal/mol	,,
<b>3.2.9 Heat of Vapourization</b>	10.2 k cal/mol	,,
<b>3.2.10 Evaporation Rate/Volatility</b>	18 mg/litre	,,
<b>3.2.11 Miscibility/Solubility in Common Solvents</b>	Miscible with water, methyl, ethyl, propyl, isobutyl alcohols. Dis- solves many in organic substances	Miscible with water and inso- luble in chloro- form, ether and hydrocarbons
<b>3.2.12 Vapour Density</b>	1.1	—

### 3.3 Chemical Properties

#### 3.3.1 Affinity for Other Chemicals

**3.3.1.1** In the liquid state, it is an excellent solvent for sulphur ( 54 g of sulphur per 100 g of  $N_2H_4$  at room temperature ).

**3.3.1.2** Hydrazine decomposes on contact with metallic oxides.

**3.3.1.3** Hydrazine is capable of forming salts with both organic (  $RCOOH$ ,  $N_2H_4$  ) and inorganic (  $N_2H_4$ ,  $HX$  and  $N_2H_4 \cdot 2HX$  ) acids.

#### 3.3.2 Important Common Reactions

**3.3.2.1** Hydrazine burns in air and vigorously with halogens, thionyl-chloride, sulphur dioxide, sulphurtrioxides and alkali metals.

**3.3.2.2** Fumes of hydrazine in air react with both oxygen and carbon dioxide in atmosphere.

**3.3.2.3** Hydrazine is capable of reducing nitrogroups to amino groups.

**3.3.2.4** Hydrazine reacts with organic acids, acid anhydrides, acid chloride, esters, thioesters and amides to form the corresponding hydrazites. With acids, such as maleic and phthalic, cyclic hydrazides are produced.

**3.3.2.5** Numerous hydrazine based polymers are possible.

**3.3.2.6** Hydrazine decomposes thermally to yield ammonia, nitrogen and hydrogen depending on the oxidizing agent or degree of heat. Even metallic oxides react violently.

**3.3.2.7** Hydrazine-air mixtures can be ignited above 130°C in a metal burner, whereas it is reported that hydrazine-oxygen mixture with platinum catalyst can ignite at only 30°C. Hydrazine hydrate and anhydrous hydrazine are highly flammable and react violently with many materials. Hydrazine may ignite spontaneously in air when in contact with porous materials, such as asbestos, earth, wood or cloth. Spontaneous ignition can occur with oxidants like hydrogen peroxide and nitric acid. Anhydrous hydrazine ignites at various temperatures depending on the surface with which it contacts. Contact with many metallic oxide surfaces may lead to flaming decomposition. For instance, ignition occurs at room temperature of 23°C with a surface of ferric oxide ( iron dust ); at 160°C with stainless steel; and 270°C with borosilicate glass.

**3.3.2.8** Hydrazine vapour is exceptionally hazardous in that once it is ignited it will continue to burn by exothermic decomposition in complete absence of air or other oxidant.

### 3.4 Fire and Explosion Hazard Properties

	<i>Hydrazine</i>	<i>Hydrazine Hydrate</i>
<i>Flash Point</i>		
i) <i>Open cup</i>	38°C ( 100°F )	72·8°C
ii) <i>Closed cup</i>	38°C ( 100°F )	—
<i>Ignition Temperature</i>	Can vary from 23°C in contact with iron rust to 132°C in contact with black iron to 160°C in contact with stainless steel, to 270°C in contact with glass	292°C
<i>Explosive Limits</i>		
<i>Lower</i>	2·9 percent	Not available
<i>Upper</i>	98 percent	Not available

	<i>Hydrazine</i>	<i>Hydrazine Hydrate</i>
<i>Spontaneous Heating or Combustion</i>	—	—
<i>Shock Sensitivity</i>	—	—

### 3.4.1 Explosion Hazards

- a) Hydrazine nitrites are pyrophoric and if heated under confinement will explode violently;
- b) The possible hazards that may arise due to  $\text{NH}_3$  in a system are:
  - (i) Precipitation of metallic oxides which are explosive, (ii) Distillation of  $\text{NH}_3$  from aqueous solutions and condensation of explosive  $\text{NH}_3$  solution, and (iii)  $\text{NH}_3$  vapour forming an explosive mixture in air.

NOTE — One such system is 0.05M  $\text{N}_2\text{H}_4$ , 0.05 M ferrous sulphamate in 5.8 M  $\text{HNO}_3$  was used as an eluting agent for plutonium from an anion exchange column.

- c) It ignites on reacting with substances, such as mercury and copper oxides. Hydrazine and hydrogen peroxide form a hypergolic mixture.
- d) Explosion hazard of hydrazine is severe when exposed to heat or flame or by chemical reaction with oxidizing agents. It is a powerful explosive and reducing agent. It is dangerous when heated to decomposition, emits highly toxic fumes of oxides and nitrogen. It is very sensitive and must not be used without full and complete instructions from the manufacturer. Explosive hazard is severe when exposed to chemical reaction with alkali metals,  $\text{NH}_3$ ,  $\text{Cl}_2$ , chromates,  $\text{CuO}$ ,  $\text{Cu}^{++}$  salts,  $\text{F}_2$ ,  $\text{H}_2\text{O}_2$ , iron rust, metallic oxides,  $\text{Ni}$ ,  $\text{Ni}(\text{ClO}_4)_2$ ,  $\text{HNO}_3$ ,  $\text{N}_2\text{O}$ ,  $\text{O}_2$ , liquid  $\text{O}_2$ ,  $\text{K}_2\text{Cr}_2\text{O}_7$ ,  $\text{Na}_2\text{Cr}_2\text{O}_7$ , tetryl, zinc, diamide,  $\text{Zn}(\text{C}_2\text{H}_5)_2$ .
- e) Hydrazine hydrate reacts violently with  $\text{HgO}$ ,  $\text{Na}$ ,  $\text{Sn Cl}_2$ , 2, 4-dinitrochlorobenzene.
- f) Distillation of anhydrous hydrazine (prepared by dehydrating hydrazine hydrate with solid sodium hydroxide) must be carried out under nitrogen to avoid the possibility of an explosion, if air is present.

## 3.5 Corrosion Properties

**3.5.1** The marked basic nature of hydrazine solutions is responsible for its corrosive nature. Hydrazine and its solutions are labelled for shipment as corrosive materials under DOT regulation.

**3.5.2** Hydrazine hydrate is a strong base, very corrosive and attacks glass, rubber and cork. Stainless steel A — 304 or A — 347 can be used. A — 316 is not recommended.

## 4. HEALTH EFFECTS AND TOXICITY INFORMATION

### 4.1 General

**4.1.1 Threshold Limit Value** 0.1 ppm ( skin ) 0.13 mg/m<sup>3</sup> hydrazine

Ceiling value Not available

Short term permissible extension do

### 4.1.2 Optimum Concentration Causing

a) Eye irritation Not available

b) Respiratory irritation Acute exposure to vapours of hydrazine causes respiratory irritation and convulsions

c) Skin irritation 1 ppm ( TLV by absorption through skin )

**4.1.3 Odour Threshold Concentration** 3.4 ppm

**4.1.4 Concentration Immediately Dangerous to Life** 80 ppm ( 104 mg/m<sup>3</sup> )

### 4.1.5 Exposure Concentration Duration and Health Effects

i) Oral LD50, rate mg/kg	60
ii) Intraperitoneal LD50, rate mg/kg	59
iii) Skin, LD50 guinea pig, mm <sup>3</sup> /kg	190
iv) Vapour inhalation 4 hour LC50 rat, ppm	570
v) Hazard index, vapour pressure 4 hour LC50	0.03

### 4.2 Routes of Entry

**4.2.1 Response in Animals** — Hydrazine derivatives tend to be local irritants, convulsants, hepato-toxic and hemolytic agents which are absorbed by all routes of administration. Hydrazine is a strong skin and

mucous membrane irritant, a convulsant, hepatotoxic and a moderate hemolytic agent. It is absorbed from the lungs, gastro-intestinal tract, parenteral injection sites and through the skin even when intact.

### **4.3 Health Effects Signs and Symptom of Exposure**

**4.3.1 Inhalation** results in eye and respiratory tract irritation with lung congestion bronchitis and pulmonary edema in some animals. Nervous system symptoms ending in convulsions are prominent after absorption by any route. Liver damage is an important feature of hydrazine toxicity, after chronic exposure. Other pathological changes, such as extra medullary homotopitac pigment ( Hemosiderin ) deposition in cells and vascular thrombosis are secondary to blood cell destruction. Hydrazine is known to be skin irritant and strong skin sensitizer.

**4.3.2 Metabolism** — Several possible metabolic pathways for hydrazine and its derivatives have been postulated, including (a) hydrolysis of hydrazides to hydrazine and the carboxylic acid, (b) reaction of hydrazine and hydrazides with natural aldehydes and ketones, (c) acetylation, and (d) splitting of symmetrical non-substituted hydrazines to yield 2 amines. Acetylation has been shown to occur with hydrazine in the rabbits but not in dogs, and with isonicotinic acid hydrazine in men, monkeys and rats. A portion of the hydrazine administered to dogs is excreted unchanged in the urine.

**4.3.3 Eyes** — Effects are limited to prompt eye irritation after the contact with vapour, severe eye damage after direct liquid contact. Small amounts of anhydrous hydrazine vapours are irritating to the eyes. Workers expo ed to vapours of hydrazine hydrate are likely to suffer from a delayed action on eyes. No effect may be felt for a period of 10 hours, but after this period eyes may become inflammed and swollen and discharge pus. There may also be temporary blindness for about 3 days. Eye splashes have a strongly irritating effect and hydrazine can cause permanent lesions. At lower concentration which may occur during manufacturing or transfer process, the warning proportions of odour may not be enough to preclude low level chronic occupational exposure in fuel handlers.

**4.3.4 Skin** — Effects are limited to prompt skin damage after direct liquid and sensitization type dermatitis. Small amounts of anhydrous hydrazine vapours are irritating to the mucous membranes and skin. Liquid is caustic and can cause severe burns when splashed on the skin. Hydrazine dissolves human hair.

**4.3.5 Inhalation** of high concentrations of hydrazine results in respiratory tract irritation with histological evidence of damage to the lungs, liver and kidneys. Inhalations of concentrations insufficient to

produce significant lung damage can result in vomiting, diarrhoea, weight loss, convulsions and death. Exposure to massive amounts first produces stimulations and convulsions, then depression and coma. In the blood, hydrazine attacks red corpuscles, reducing the oxygen supply. Cyanosis may result in lips, tongue and earlobes turning blue or purple.

#### **4.3.6 Toxic Hazard Rating**

- a) *Acute local* — irritant — high; ingestion — high; inhalation — high.
- b) *Acute systemic* — ingestion — high; inhalation — high; skin absorption — high.
- c) *Chronic local* — allergen — high.
- d) *Chronic systemic* — ingestion — high, inhalation — high, skin absorption—high.

**NOTE** — Rating of 'high' indicates that the chemical may cause death or permanent injury after very short exposure to small quantities.

### **5. STORAGE, HANDLING AND TRANSPORT**

#### **5.1 Storage**

**5.1.1 Hydrazine hydrate** is stored in polyethylene carbuoys in case of small quantities and in mild steel drums with polyethylene lining in case of larger quantities. Containers having hydrazine hydrate should be stored with stoppers up. For indoor storage, standard combustible liquid storage room should be used. The distance between each of the containers should be not less than 0.5 metre and they should not be kept one over the other. Hydrazine hydrate should not be stored for more than one year. Very little quantites of hydrazine liquids can be kept in glass bottles. The bottles should be cleaned before using. Residues on the glass may reduce the ignition temperature. While keeping in glass bottles, leave sufficient head space as it attacks cork, rubber and other organic materials. Hydrazine can be stored for years, if sealed in glass and kept in a cool, dark place.

Do not use impure containers or bottles and also do not use the empty containers of hydrazine for any other chemicals.

**5.1.2 Ventilation system** shall be good and effective.

**5.1.3 Flooring** shall be of non-combustible material. PVC lining on the flooring is preferable.

**5.1.4** All electrical fittings shall be explosion-proof and conforming to IS : 8240-1976\* and IS : 2148-1968†.

**5.1.5** No flammable organic or inorganic chemical, oxidising material, such as metal oxides, peroxides and acids should be stored near hydrazine hydrate. No work connected with open fire, gas or electric welding should be carried out in the vicinity of hydrazine hydrate. All work in the storage area should be done with non-sparking tools. In order to reduce the flammability hazard and to maintain purity, it is usually stored under nitrogen. Rooms containing the bulk storage shall be identified by signs indicating the presence of hazardous chemicals pasted on all the doors and windows. 'NO SMOKING' warning is a must. Roofing of the stores should be in good condition to protect the area from sun and rain. Under no conditions, the containers should be left in the open air.

Other important precautions include providing water facility for flushing the spills or leaks; earthing the tank to prevent the accumulation of static electricity; inspection of the area periodically; using only the insulated containers and keeping them in water baths; never to locate the storage area closed to the main roads; adoption a well defined order for security personnel to enter into storage area for handling and periodic inspection.

## **5.2 Handling**

- a) Wear the necessary personal protective appliances which are in good condition;
- b) Avoid direct contact with skin;
- c) Empty containers before discarding shall be cleaned of their contents and treated with a deactivating agent;
- d) Avoid heat sources, such as welding, gas cutting heat treatment operation where hydrazine is handled;
- e) All operations shall be carried out in a perfectly closed system or fumehood or chambers in areas having good ventilation of 6 to 30 air changes per hour. All fume hood operations shall be done with a face velocity of 30 m per minute;
- f) Proper eye wash fountains and showers should be provided;

---

\*Guide for electrical equipment for atmospheres.

†Flameproof enclosures of electrical apparatus ( *first revision* ).



- g) Intimate the nearest or authorised physician about the usage of hydrazines prior to handling; and
- h) Trays should be used for handling reagent bottles, or laboratory equipment whenever there is a chance of spill.

### **5.3 Transport**

**5.3.1** While loading, transporting and unloading of the barrels from the vehicles, one should be careful not to strike against them with metallic tools to avoid sparking, etc. Avoid conditions which may cause damage, such as dropping from heights.

**5.3.2** Hydrazine hydrate should not be transported along with other products. In case of leakage, transfer the contents into a good PVC container keeping in view of the hazard factors. Neutralise the spillage as suggested in 7. *Never roll the drums.* Transport them with proper self gripping type lifting tackles or trolleys.

**5.3.3** The transporter must be given the details of the hazards before booking the consignment for outside movement. Hydrazine hydrate can be transported by any means, provided the instructions for the transportation are strictly adhered to. The personnel involved in the transportation of this chemical should carry the appropriate fire extinguisher and gas masks with them. Also display the name of the contents and their hazardous properties on the tanker before transporting. Use only tankers and jars which are in good condition. Always protect the containers from the direct sunlight. Hydrazine and its solutions are labelled for shipment as corrosive materials under DOT regulation.

## **6. FIRE PREVENTION AND FIRE FIGHTING**

**6.1** In the case of fire, flood with water the area where the hydrazine hydrate is spilled and caught fire. Extinguishers of dry chemical powder and carbondioxide type may be used, but flooding with water is still a must to prevent re-ignition. Alcohol foam is effective on spill fires. In massive fires, fire fighting shall be done from a safe distance or from a protected location. Use water to keep fire exposed containers in a cool state. If a leak or spill has not ignited, use water spray to disperse the vapours and to dilute spills to non-flammable mixtures.

**6.2** Information for types of extinguishing agents and equipments which should not be used should be made available.

## 7. SPILLAGE, LEAKAGE AND SCOPE OF MATERIALS

**7.1** In case of concentration of hydrazine hydrate more than the threshold limit value, dilution of ventilation shall be attempted immediately after stopping the handling, till the satisfactory level is reached.

**7.2** In case of spills, flush with large amounts of water. For small pools on tables, floors, etc, use a pipette and rubber bulb or pick up the liquid as much as possible. Neutralize carefully with sulphuric acid. Small amounts could be flushed into a sink drain with water. If hydrazine soaks into a porous surface, first remove the standing liquid and then flood the damp spot with a 5 percent solution of boric acid.

**7.3** Facilities such as fans for diluting the ventilation, suitable source of water for flooding the spilled area, drainage provisions, necessary personal protective equipments, etc, are to be provided before handling.

**7.4** Protection of persons engaged — See 11.

## 8. WASTE DISPOSAL

**8.1** Most of the waste containing the chemical will be only in the liquid form.

**8.2** The waste should be diluted to at least 40 percent and neutralized with dilute sulphuric acid. Flush to sewer with excess water. Another method is to dissolve the waste in large volume of waste alcohol or in other flammable solvent and burn it in an open pit. While burning, make sure that it is ignited from a safe distance.

## 9. FIRE PREVENTION

**9.1** All electrical fittings near the bulk storage area as well as close to the handling zone shall be of explosion proof conforming to IS : 2148-1968\* and IS : 8240-1976†.

**9.2** Control of Ignition Source — See 5.1.5.

**9.3** Electrical Continuity and Earthing — Earth all the tanks to prevent the accumulation of static electricity. Earthing may be done according to IS : 3043-1966‡.

---

\*Flameproof enclosures of electrical apparatus ( *first revision* ).

†Guide for electrical equipment for atmospheres.

‡Code of practice for earthing.

## **10. HAZARD INFORMATION**

**10.1** The storage area as well as the place where the hydrazines are handled in large quantity shall be provided with symbols displaying corrosive nature of the chemical.

**10.2** The caution and warning notice shall include the following:

- a) Name of the chemical and quantity stored, on all the doors and windows;
- b) Keeping heat, flame sources, etc, away; and
- c) Type of extinguishers to be used in case of fire.

**10.3** Information on labels shall include:

- a) 'NO SMOKING';
- b) First aid measures ( *see 14* );
- c) Emergency telephone numbers ( fire service, ambulance, etc ); and
- d) List of persons to be contacted for fire and first aid assistance.

## **11. PERSONAL PROTECTIVE EQUIPMENT**

**11.1** Personal protective equipment is not an adequate substitute for safe working conditions. Though it is used to reduce the severity of incidences and to meet emergency situations, all operations are to be well planned and systematically taken up without leaving any chance for the hydrazine hydrate to come out.

**11.2** Employees who handle hydrazines shall wear appropriate respiratory protection and safety equipment.

**11.3** For handling inside the fumehood, wear PVC gloves and sleeves for hands, chemical goggles for eyes or face shields to cover the entire face and PVC apron. For attending large scale handling, attending leaks and spills, cleaning of equipments, etc, PVC suit with gumboot is recommended. In the absence of PVC suit, it is advised to use PVC gloves, sleeves, aprons and gumboots, appropriate goggles and airline respirator or self-contained breathing apparatus.

## **12. TRAINING AND EDUCATION**

**12.1** The staff members who are handling hydrazines shall be provided with information on the properties of hydrazines before they handle, through well planned training programmes.

**12.2** Preplacement training in emergency procedures shall include, fire fighting, how to deal with spills, disposal procedures and first aid.

**12.3** Periodical refresher training ( at least once in two to three years ) shall be imparted to the staff members who handle hydrazine on the aspects covered in **12.1** and **12.2**.

### **13. HEALTH MONITORING**

**13.1** General physical check up to be carried out before placing the personnel for sound health and body system. Preplacement examination should include a history of exposure to other carcinogene, smoking, alcohol, medications and family history.

**13.2** The personnel should be subsequently examined periodically, particularly for sputum and urine cytology and blood analysis for hydrazine.

**13.3** Findings of examination and results of tests performed should be properly recorded.

### **14. FIRST AID**

#### **14.1 Action in Emergency**

##### **14.1.1 Poisoning**

- a) Call for ambulance;
- b) Loosen tight clothing and remove obstructions, if any;
- c) Take off the contaminated clothing immediately because of the skin burns which can possibly result in absorption through skin;
- d) Apply artificial respiration immediately if breathing is stopped or is irregular; and
- e) If swallowed, do not induce vomitting if patient is unconscious or is in convulsions. If patient can swallow, give milk, water or milk of magnesia ( one table spoon to one cup of water ). Suggested dose is up to 100 ml.

##### **14.1.2 Inhalation**

- a) Do not rescue the injured without wearing mask,
- b) Move the patient to fresh air immediately, and
- c) Carry out steps given in **14.1.1** (a) to (d).

**14.1.3 Skin Contact**

- a) Immediately remove the contaminated clothing and jewellery and drench skin with plenty of running water,
- b) Institute general first aid measures that apply,
- c) Cover the injured area with loosely applied clean cloth,
- d) Avoid the application of ointments or drugs unless it is recommended by the physician,
- e) Send the victim for medical care, and
- f) Do not put on the contaminated clothes again. Ensure its thorough cleaning before reuse.

**14.2 Splash on Face or Eyes**

- a) Holding the eye lids open, immediately wash the eyes and face thoroughly in the eye fountains or in a stream of running water.
- b) Arrange for the immediate medical attention since the splash in the eyes can result in permanent damages.
- c) Never use eye drops or other chemicals. They may increase the extent of injury.

**14.3 Information to be provided to physicians rendering medical aid:**

- a) Always send the patient with case history or full details of accidents including the name of the chemicals which caused the injury or sickness; and
- b) Include the suggested treatments if proper antidote, etc, could be specified confidently. Otherwise leave it to the physician.

( Continued from page 2 )

<i>Members</i>	<i>Representing</i>
SHRI A. N. RAO	Directorate General of Technical Development, New Delhi
SHRI V. V. M. RAO	Hindustan Petroleum Corporation, Bombay
SHRI D. V. A. RAJU ( <i>Alternate</i> )	
SHRI DEEPAK R. SHAH	Excel Industries Ltd, Bombay
SHRI S. S. KAIMAL ( <i>Alternate</i> )	
SHRI K. K. SUBRAMANIAN	National Organic Chemical Industries Ltd, Bombay
SHRI M. C. PATWARDHAN ( <i>Alternate</i> )	
SHRI S. A. TRIVEDI	Navin Fluorine Industries, Bombay
SHRI J. N. PAREKH ( <i>Alternate</i> )	
SHRI H. K. VENKATARAMIAH	Hindustan Organic Chemicals Ltd, Rasayani
SHRI A. G. SHESHAH ( <i>Alternate</i> )	

## BUREAU OF INDIAN STANDARDS

### Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, NEW DELHI 110002

Telephones: 323 0131, 323 3375, 323 9402

Fax : 91 11 3234062, 91 11 3239399, 91 11 3239382

Telegrams : Manaksanstha  
(Common to all Offices)  
Telephone

### Central Laboratory:

Plot No. 20/9, Site IV, Sahibabad Industrial Area, Sahibabad 201010

8-77 00 32

### Regional Offices:

Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg, NEW DELHI 110002 323 76 17

\*Eastern : 1/14 CIT Scheme VII M, V.I.P. Road, Maniktola, CALCUTTA 700054 337 86 62

Northern : SCO 335-336, Sector 34-A, CHANDIGARH 160022 60 38 43

Southern : C.I.T. Campus, IV Cross Road, CHENNAI 600113 235 23 15

†Western : Manakalaya, E9, Behind Marol Telephone Exchange, Andheri (East),  
MUMBAI 400093 832 92 95

### Branch Offices::

'Pushpak', Nurmohamed Shalkh Marg, Khanpur, AHMEDABAD 380001 550 13 48

‡Peenya Industrial Area, 1st Stage, Bangalore-Tumkur Road,  
BANGALORE 560058 839 49 55

Gangotri Complex, 5th Floor, Bhadbhada Road, T.T. Nagar, BHOPAL 462003 55 40 21

Plot No. 62-63, Unit VI, Ganga Nagar, BHUBANESHWAR 751001 40 36 27

Kalaikathir Buildings, 670 Avinashi Road, COIMBATORE 641037 21 01 41

Plot No. 43, Sector 16 A, Mathura Road, FARIDABAD 121001 8-28 88 01

Savitri Complex, 116 G.T. Road, GHAZIABAD 201001 8-71 19 96

53/5 Ward No.29, R.G. Barua Road, 5th By-lane, GUWAHATI 781003 8-11 37

5-8-56C, L.N. Gupta Marg, Nampally Station Road, HYDERABAD 500001 20 10 83

E-52, Chitaranjan Marg, C- Scheme, JAIPUR 302001 37 29 25

117/418 B, Sarvodaya Nagar, KANPUR 208005 21 68 76

Seth Bhawan, 2nd Floor, Behind Leela Cinema, Naval Kishore Road,  
LUCKNOW 226001 23 89 23

NIT Building, Second Floor, Gokulpat Market, NAGPUR 440010 52 51 71

Patliputra Industrial Estate, PATNA 800013 26 23 05

Institution of Engineers (India) Building 1332 Shivaji Nagar, PUNE 411005 32 36 35

T.C. No. 14/1421, University P. O. Palayam, THIRUVANANTHAPURAM 695034 6 21 17

---

\*Sales Office is at 5 Chowringhee Approach, P.O. Princep Street,  
CALCUTTA 700072 27 10 85

†Sales Office is at Novelty Chambers, Grant Road, MUMBAI 400007 309 65 28

‡Sales Office is at 'F' Block, Unity Building, Narashimaraaja Square,  
BANGALORE 560002 222 39 71